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Three hundred and fifty-eighth meeting.

February 24, 1852. — SPECIAL MEETING.

The PRESIDENT in the chair.

J. I. Bowditch, Esq., in the absence of the chairman of the committee appointed to confer with the Trustees of the Boston Athenæum, on the subject of obtaining a room for the use of the Academy in the Athenæum, made a report. After much discussion, it was *voted*,

1. That the report of the committee be accepted.
2. That the contract entered into by the committee, in behalf of the Academy, for the use of the northeast room on the lower floor of the Athenæum, for the period of ten years, on the terms specified in the committee's report, be ratified.
3. That the same committee be empowered to complete the arrangement with the Trustees of the Athenæum.
4. That the same committee be empowered to effect the removal of the books belonging to the Academy, and to dispose of the book-cases in such manner as they may see fit.

Three hundred and fifty-ninth meeting.

March 2, 1852. — MONTHLY MEETING.

The PRESIDENT in the chair.

Mr. Winthrop, in behalf of the committee on the subject of Professor Eustis's plan of the late tornado, submitted the following report : —

“The committee of the Academy, to whom was referred a plan exhibiting the ravages of the tornado of August, 1851, by Professor H. L. Eustis, beg leave to report, —

“That they have examined this map with great interest, and are unanimously of the opinion, that it forms a very valuable contribution to the cause of meteorological science.

“In meteorology, as in every other science, much more depends on the fidelity and accuracy of observations and experiments, than on the multiplicity of them. A single tornado, carefully and thoroughly surveyed, is worth a hundred of which the track has only been galloped over by the observer.

“Any theory which cannot explain a tornado which has been impartially and rigidly investigated throughout an extensive sweep, may be fairly rejected as insufficient. Those facts which relate to position and direction admit most easily of this rigid investigation, and, by being placed on a map, they may be preserved in a compact and available form for future reference, and may serve as the touchstones of future or of existing theories.

“The map of the late tornado now under consideration is probably without example both in the completeness and minuteness of its details, and in the great length of track which it covers, — larger than the whole track of many tornadoes. It may well deserve consideration, whether, in the history of other tornadoes, the area which has been specially studied was large enough to insure the separation of the leading features of the phenomena from what was merely local and accidental. The present map includes an extent of not less than three miles and a quarter in length, and was the result of a survey of eleven days by Professor Eustis himself, aided by an average number of twenty assistants, in the field during the whole time, from among the pupils of the Engineer Department in the Lawrence Scientific School at Cambridge.

“The committee are unanimously of the opinion, that the Academy will subserve the cause of science by ordering this map to be printed, and they have accordingly made some inquiries, and obtained some estimates as to the cost and manner of publication. As the result of these inquiries, they propose the following resolutions : —

“ ‘ *Resolved*, That the map of the late tornado presented to the Academy by Professor Eustis be lithographed, under the direction of the Committee on Publications, on its present scale, and at an expense not exceeding \$ 500 for five hundred copies; to be paid by subscription.

“ ‘ *Resolved*, That Professor Eustis be requested to superintend the publication, and to prepare a memoir or explanation to accompany the map.

“ ‘ *Resolved*, That a subscription paper be opened to defray the expense of publication.’ ”

These resolutions were adopted by the Academy.

Professor Lovering called the attention of the Academy to a beautiful corona seen about the moon, on the evening of December 3d, 1851, and remarked, that, “in phraseology at

least, a distinction was not always observed between the various classes of phenomena which relate to optical meteorology.

1. There are those which depend on reflection alone.
2. There are those which depend on refraction alone.
3. There are those which result from the combined effect of reflection and refraction.
4. There are those which depend on diffraction, or the interference of light.

Rainbows belong to the third class. Halos, properly so called, belong generally to the second; but in their more complicated forms, when accompanied with streams of light and mock suns or moons, they belong to the third class. Coronæ, properly so called, belong to the fourth class. *Halos* and *coronæ* are frequently confounded together, although they have each its own very decided characteristics. Halos are produced by refractions, either with or without reflection. The ordinary value of the diameter of these circles, which is either 47° or 94° , has suggested the theory that they are produced by refraction in prisms of snow or ice, in which the refracting angle is 60° . The arrangement of the colors is prismatic, the red occupying the place of the smallest circle. Experiments with a polariscope show that the light of the halo is polarized by refraction. The crystals which produce the refraction are supposed to exist in the region of the *cirrus* cloud, so that the halo is often taken as evidence of the first approach of that cloud, even when the cloud itself cannot be distinctly seen. Mr. Lovering exhibited various specimens of plates of fibrous crystals, cut perpendicular to the fibre, which produce upon light changes very analogous to those wrought on a larger scale by the atmosphere in the production of halos, and which serve, therefore, to give an idea of the structure of those clouds which develop these extraordinary optical phenomena of the air. Volume XVIII. of the Journal of the Royal Polytechnic School, published at Paris in 1847, was also exhibited. M. A. Bravais has occupied the whole of this volume in an analytical discussion of halos, and has enriched his work with copies of the most distinguished appearances of this kind on record, selected from all the journals of Europe and America.

“The characteristics of the corona are as decided as those of the halo. The arrangement of the colors, in which the red occupies the outside and the violet the inside, points to interference, and not to refraction, as the physical cause of these colors. It is an exhibition of diffraction on a large scale, similar to the experiment of looking at a small flame through a piece of thin glass, which has been sprinkled over with lycopodium powder, or which is covered with minute particles of smoke or moisture. In all these cases we see the flame surrounded by colored rings, which are larger as the particles of powder, which pave the way for the interference of the light which passes through their interstices, are smaller. The corona is produced by the *cumulus* cloud, in which the water exists in a vesicular state ; not unlike in structure to a piece of network, which is known to occasion interferences in light similar to those which are here attributed to the cloud. Coronæ are much smaller than halos. They are between 3° and 12° in diameter. From the size of the corona in any case, it is possible to calculate the size of the vesicles in the cloud. According to the indications above mentioned, the appearance of the 3d of December is to be classed among coronæ, and not among halos. Mr. Lovering had proposed to illustrate the subject by scattering lycopodium powder on glass, and looking through it at a flame. But the number and the size of the gas-burners with which the room where the Academy assembled was lighted were not propitious for such an experiment, which requires a single and small source of light.”

Mr. G. P. Bond gave the results of observations recently made at the observatory of Harvard College, upon two of the inner satellites of Saturn, Tethys and Enceladus. “The permanence of the mean motions of the latter over a period of several thousands of its years was mentioned as an interesting fact. Its mean distance also agreed nearly with that derived from the periods and distances of the outer satellites. Should this be sustained by further observations upon the two nearest

satellites, an argument might be derived from the fact for the smallness of the mass of the ring, — since, for bodies so near to it, its attraction will differ considerably from what it would be were all its mass collected in the centre.

“The method employed by Bessel, in which the mass is derived from the motion of the line of apsides (a constantly accumulating quantity), is a better one.”

Professor Peirce made further remarks upon the same subject.

Dr. B. A. Gould, Jr. exhibited to the Academy an admirable model, to represent the orbits of the sixteen asteroids, which was recently made by Chamberlain and Ritchie for the Lowell Institute, under his directions.

Three hundred and sixtieth meeting.

April 6, 1852. — MONTHLY MEETING.

The **PRESIDENT** in the chair.

On motion of Mr. J. I. Bowditch, who stated that the Librarian was sick, it was

Voted, That the charge of removing the Academy's books to their new room in the Athenæum be transferred to the Committee on the Library.

Dr. J. C. Warren gave an account of his visit to Darmstadt, in the year 1851, to see the Eppelsheim fossils, and exhibited a considerable number of casts of fossil bones of the *Dinothe-rium giganteum*, together with an excellent colored drawing, of the natural size, of the head.

“Having become much interested in the Eppelsheim fossils, I took the opportunity while in Europe in 1851 to visit Darmstadt, where this collection is, and its able and excellent Professor, M. Kaup.

“Darmstadt, the capital of the Grand Duchy of Hesse, is situated at a short distance from the Rhine, and near to Frankfort. The town contains about eight thousand inhabitants. It is built of stone, with wide streets, has many public ornaments, and is surrounded by gardens and groves, which extend in some directions for miles, and contribute to make it a desirable residence.

“The collection is placed in the Castle, so called, and is rich in